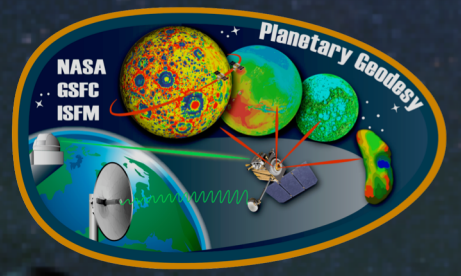
High-accuracy illumination modeling



Team:

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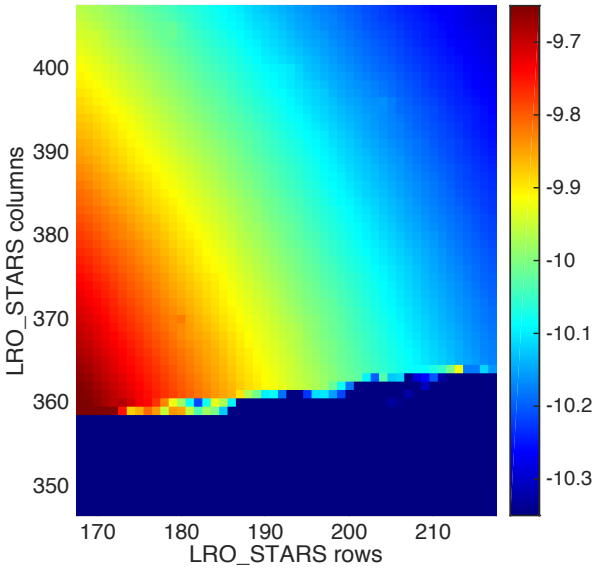
In collaboration with 61A, UMCP, UCLA, APL, PSI

Short Summary

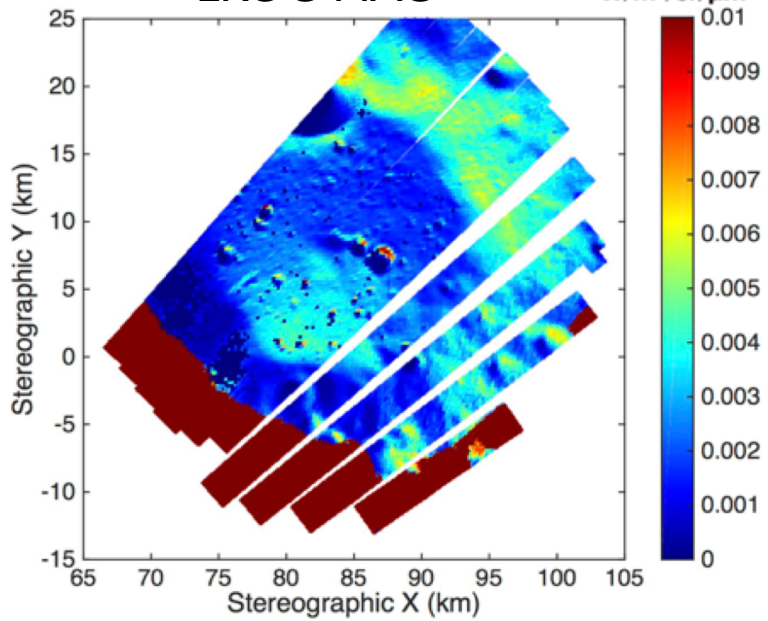
- Maintenance and continued development of numerical codes for illumination modeling
- We use flexible, high-accuracy models in order to forward-model complex measurement geometries, using large high-resolution shape models
- This allows us to refine data calibration and analysis of important datasets, such as those from LRO.
- We collaborate to continue the analysis of these datasets that inform our knowledge of the presence and distribution of volatiles in the Solar System.

Duration of Award: FY18-19

LRO Star Tracker



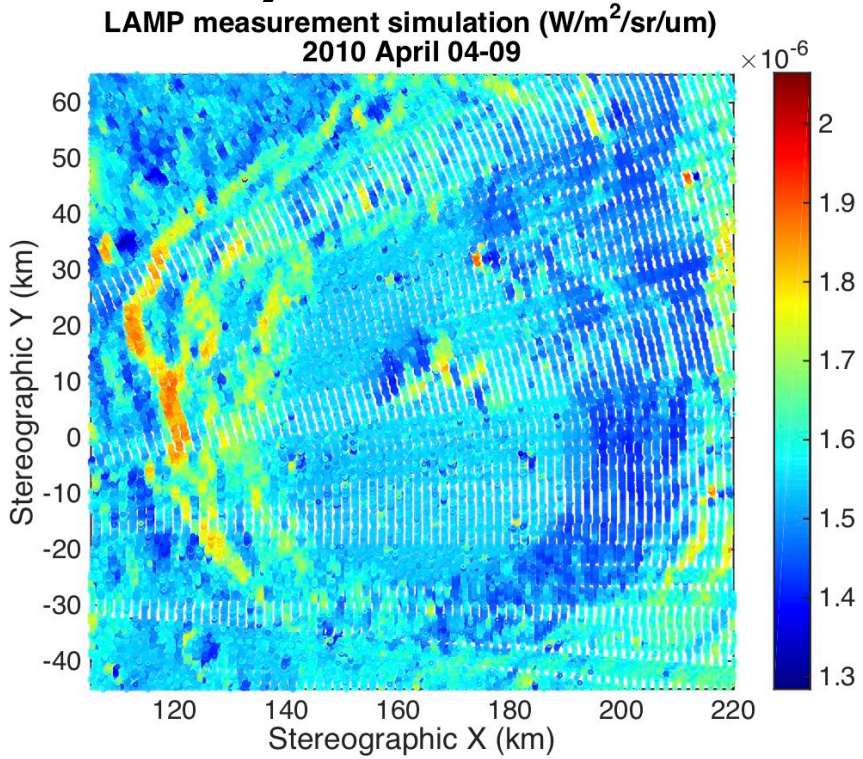
LROC NAC



Various capabilities are available in our illumination modeling tool, including the ability to model doubly-scattered radiation and to simulate camera images. (left) Using a high-resolution lunar shape showed that doubly-scattered radiation may be responsible for a suspicious 'hot' pixel. (right) Modeling of LROC NAC long-exposure images may help reveal albedo anomalies within lunar polar PSRs.

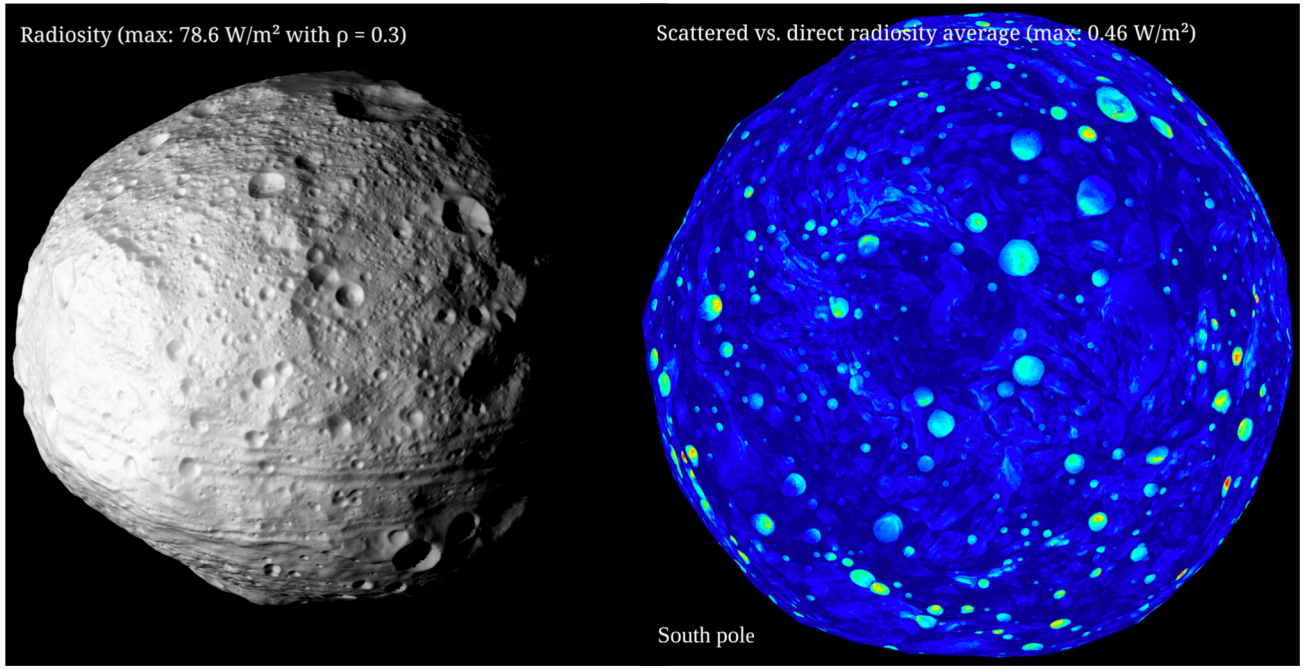
Major Findings or Results

Support of Data Calibration and Analysis



Computation of surface-reflected flux from 1000 UV-bright stars over Amundsen crater (near lunar south pole) over LRO-LAMP groundtrack.

Collaboration with UMCP to take advantage of new techniques



The radiosity method allows accurate illumination (incl. multiple scattering) and thermal modeling. Here with (4) Vesta.

Metrics Delivered

- Poster presented at the LPSC 2018 meeting in March 2018
- Papers:
  - Mazarico et al., Advanced Illumination Modeling for Data Analysis and Calibration. Application to the Moon, Advances in Space Research, doi:10.1016/j.asr.2018.08.022, in press.
  - Rubanenko et al., Ice In Micro Cold-Traps on Mercury: Implications for Age and Origin, Journal of Geophysical Research, doi: 10.1029/2018JE005644, in press.
  - Susorney et al., The thickness of radar-bright deposits in Mercury's northern hemisphere from individual Mercury Laser Altimeter tracks, submitted to Icarus
- Orbit products, test mosaic, new camera models, and Kaguya data sets with updated geolocation (altimetry, magnetic data) will be publicly archived
- New collaboration with UMCP; ongoing collaboration with APL, UCLA, PSI
- Future work:
  - Continue development of radiosity-based program
  - Continue analysis of volatile-related datasets at Mercury, the Moon, and Ceres